United States
Department of
Agriculture

Forest Service
Pacific Northwest Region
R6-NR-WFW-05-05
Portland, OR
July 2005

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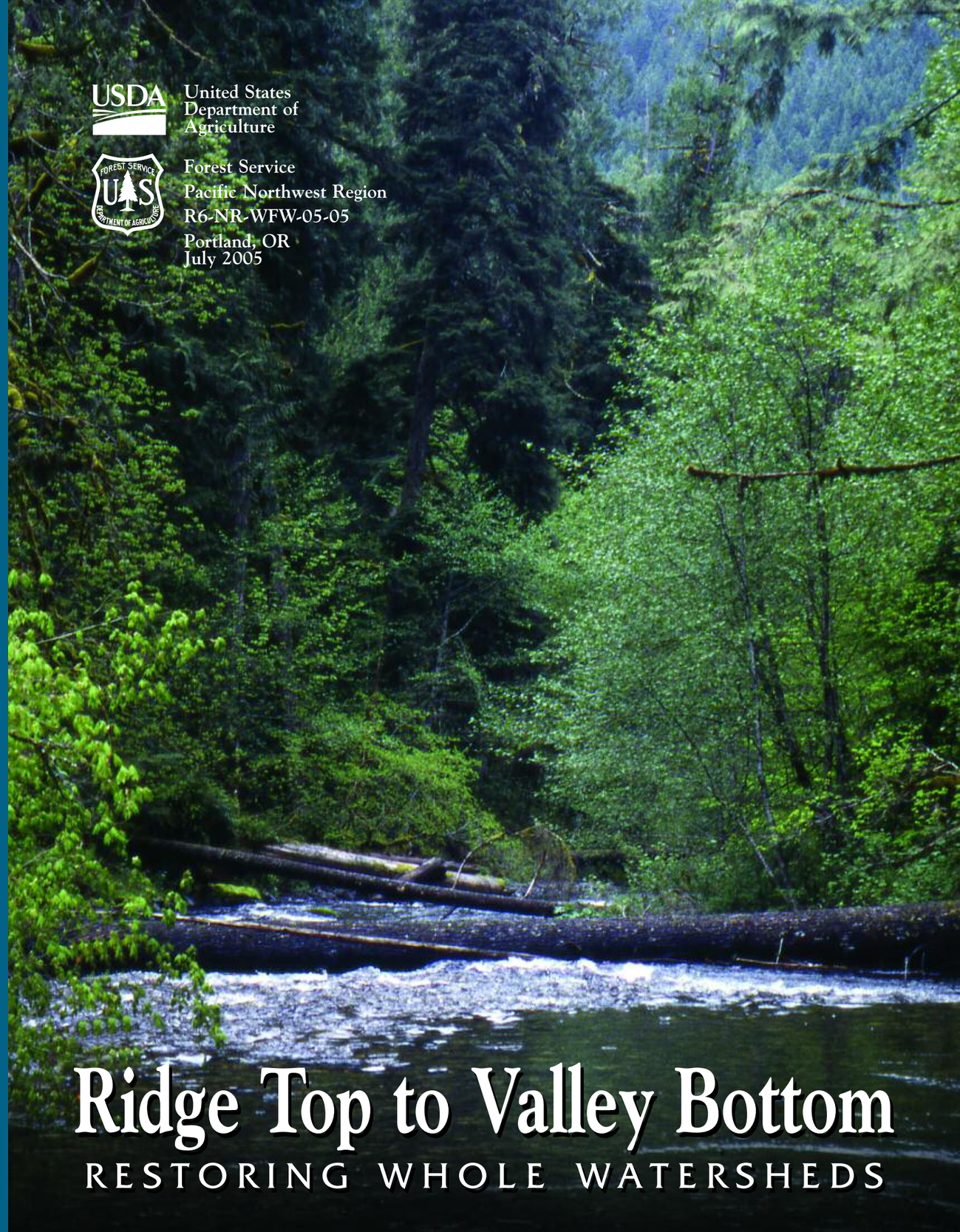


Ridge Top to Valley Bottom

RESTORING WHOLE WATERSHEDS

Welcome

WHOLE WATERSHED RESTORATION

Welcome to a profile of completed watershed restoration efforts from the Pacific Northwest Region of the Forest Service. Over the last decade we have been working diligently to maintain, restore, and protect native fish species and the streams they inhabit. Restoring watersheds is good not only for fish and wildlife, but also for the people in the Northwest. A University of Oregon study for the Oregon Watershed Enhancement Board (“*Restoration*” newsletter, January 2003, Issue No. 32, p. 9), found that for each dollar spent in restoration:

- More than $0.80 stays in the County where work occurs, supporting local businesses because supplies, equipment, and contracted services are acquired locally;
- Over $0.96 stays in the State; and
- There is $1.68 - $2.50 of additional related spending in that County.

In the following pages you will find descriptions of a variety of watershed restoration efforts throughout Oregon and Washington. These watersheds were chosen as examples because they demonstrate:

- Identification of highest priority needs through comprehensive whole-watershed assessment;
- Completion of all high priority treatments and the significant responses that can occur with these focused efforts; and
- The diversity of approaches needed and currently in use across the varying landscape of the Pacific Northwest.

The broad range of project activities apparent in these restoration stories reflects the diversity of watershed conditions and stream ecosystems across Oregon and Washington, as well as the differing history (type and intensity) of human use in these watersheds. Projects highlighted in this report represent a variety of approaches with an array of treatment combinations—ranging from road removal to stream channel reconstruction to prescribed fires—all with a common end goal of ecosystem restoration. Much of this work would not have been possible without the assistance of our many federal, state, local, tribal, and non-profit partners as well as individual landowners. These restoration projects represent true success in collaboration.

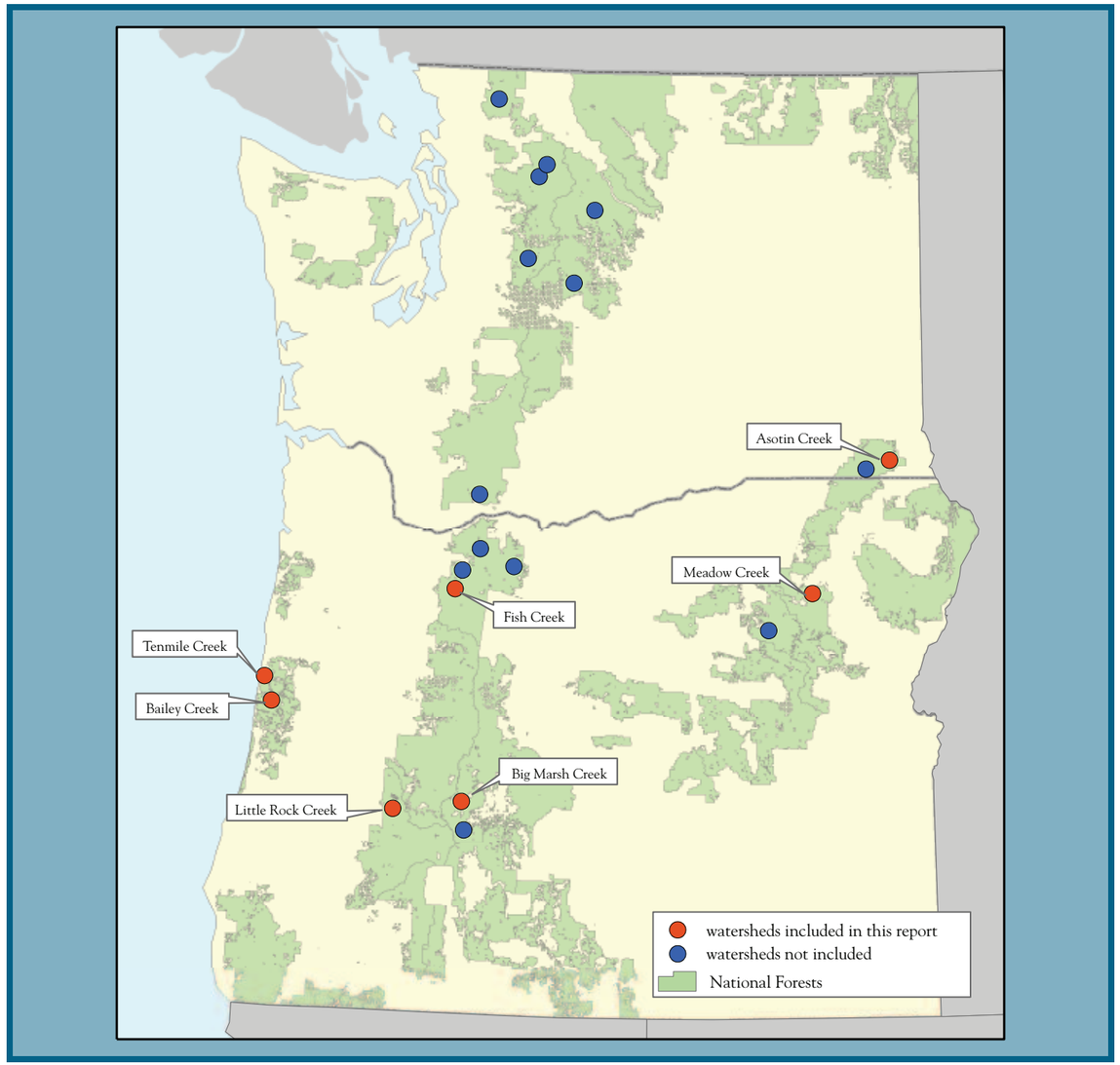
As you read this report, I hope you join me in taking pride in the significant strides we’ve made over the last decade.

Thanks for your interest!

Linda Goodman

Linda Goodman
Regional Forester

Watershed Map



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WHOLE WATERSHED RESTORATION

Front cover photo by D. Heller

Introduction

COMPLETING RESTORATION OF WHOLE WATERSHEDS

Watershed restoration is a critical component for conservation and recovery of native fish stocks, water quantity and quality, and a host of other plant and animal species on National Forest System (NFS) lands of the Pacific Northwest. There is a legacy of impacts in many streams/watersheds from past disturbances including historic land management activities and natural events. Restoration efforts are designed to complement protection measures and to increase the number and distribution of healthy watersheds and the valuable resources they provide. Many NFS lands contain the "headwaters" of streams—that is, the tributary streams from which a creek or river rises—so actions taken on NFS lands are often key in determining the aquatic health of downstream areas. Restoration projects provide not only ecological benefits, but also human health, recreation, and economic benefits for local communities.

Of the 686 watersheds with NFS ownership in the Pacific Northwest Region, approximately half are targeted for restoration. In the past 10 years, restoration has been completed in more than 20 important watersheds (see map). This means that all priority work needed to speed recovery of watershed health has often been identified and completed, and monitoring results show that these actions are making a difference to fish habitat and populations. These successes have been made possible through new approaches to watershed restoration including:

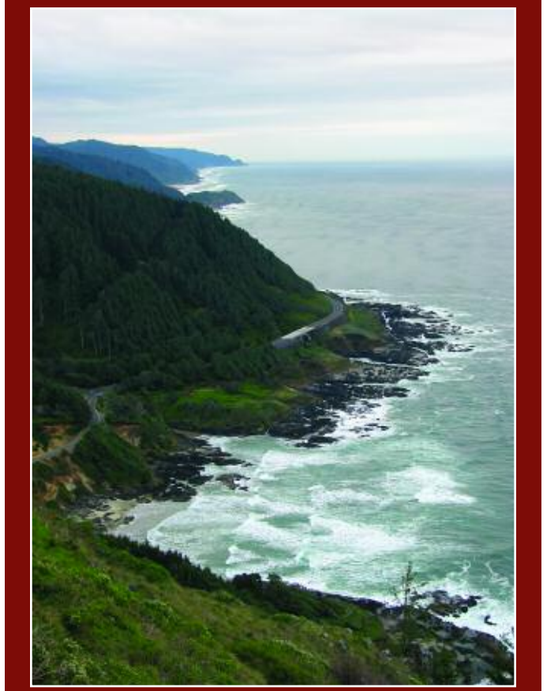
- Prioritization of watersheds for treatment;
- Selection and focus of work on a limited number of watersheds to strategically apply agency and partner budgets;
- Use of watershed analyses to diagnose watershed condition and to develop strategies to treat those watersheds needing restoration;
- Use of integrated, watershed-scale treatments applied from ridge top to valley bottom; and
- Close involvement and cooperation of communities, landholders, and partners to address issues throughout entire watersheds.

This report documents the completion of restoration on selected watersheds throughout the Pacific Northwest Region. Each case study is a story of teamwork, professionalism, and dedication in improving the condition of our aquatic resources. The first four case studies showcase whole watershed restoration in different land settings and resource conditions each with a unique mix of treatments. The last section highlights some restoration techniques which are becoming increasingly important for the completion of effective, whole watershed restoration.

Watershed restoration uses a variety of techniques to improve fish habitat in streams. In the Fish Creek watershed, a road adjacent to the stream was removed which reduced sediment entering the stream and allowed re-establishment of riparian vegetation and important channel processes.

Tenmile Creek

HIGHLIGHTED WATERSHED



Tenmile Creek is an Oregon coastal tributary.

Siuslaw National Forest

Oregon Department of Fish and Wildlife
National Audubon Society

History of Tenmile Creek

- European settlers arrived in the early 1900's and began clearing streamside trees to allow grazing and farming.
- Logging and road building began on the valley hillsides in the 1950's.

Tenmile Creek Watershed

- Area: 23 square miles
- Habitat: 25 miles of fish bearing streams
- Tier 1 Key Watershed, a high priority for protection and restoration
- ESA listed species: coho salmon, spotted owls, marbled murrelets
- Other fish species: Chinook, chum, steelhead, cutthroat, pacific lamprey, western brook lamprey, sculpin, eulachon
- Watershed analysis completed 1995
- Priority watershed restoration treatments were completed between 1996 and 2003.

The Need for Restoration

Prior to restoration and road decommissioning, there were many road-related landslides in the watershed (left). These slides often move large volumes of sediment and wood which affect stream channels and fish habitat (right).

Tenmile Creek

HIGHLIGHTED WATERSHED

The Restoration Approach

This project enhanced a free-flowing coastal river by restoring ecological processes, particularly reducing road-related risk and eliminating barriers to recovery. Restoration activities were focused on reducing the number of landslides, recovering aquatic habitat quality and complexity, and improving forest and riparian area conditions.

Restoration Objective	Treatments
Reduce road-related landslides	– Road stabilization and decommissioning
Accelerate development of late successional forest conditions	– Thinning – Control of competing vegetation – Planting
Increase salmonid freshwater survival rates and restore channel complexity	– Addition of wood to streams – Move riparian campsites
Return movement of aquatic species through riparian area	– Remove road next to stream – Riparian planting
Reduce fragmentation of valley bottom lands	– Strategically acquire high priority lands from willing sellers

A helicopter was used to bring in more than 240 large trees to sections of stream lacking in wood. Large trees, typical of a mature riparian area, are more stable and provide better habitat for juvenile fish during winter high flows.

The photo above shows an area where a road and a gravel pit located in the floodplain were decommissioned. The road was de-compacted, planted with native riparian vegetation, and a portion of a tributary of Tenmile Creek was redirected back into the historic channel. The final result was restoration of several hundred feet of important over-wintering habitat and winter flood refugia for fish and other aquatic species.

Tenmile Creek

HIGHLIGHTED WATERSHED

Restoration Accomplishments

Restoration projects were completed between 1996 and 2003. A key action was the acquisition of nearly 1,400 acres of mostly valley bottom land bordering Tenmile Creek. Roads no longer needed or posing a risk to slope stability were decommissioned and returned to a hydrologically stable condition. Several mid-slope and some valley bottom roads were decommissioned, and important riparian area function is being restored.

Restoration Treatment	Accomplishments
Land acquisition	1150 acres – 5.5 miles adjacent to Tenmile Creek – Siuslaw National Forest 116 acres – 1.0 miles adjacent to Tenmile Creek – Audubon Society 100 acres – 0.5 miles adjacent to Tenmile Creek – Pine Tree Conservation Society
Road stabilization	51 miles stabilized (65% of watershed; 72% of Forest Service roads) through treatments such as decommissioning and improving drainage 20,000 cubic yards of road fill removed from around culverts at road-stream crossings
Riparian function	48 stream channels re-connected
Plantation thinning	62 acres of commercial thinning adjacent to 15 miles of stream 700 acres of non-commercial thinning adjacent to 15 miles of stream
Riparian planting and control of competing vegetation	60 acres of riparian planting and competing vegetation control adjacent to 4 miles of Tenmile Creek
Addition of wood to stream channels	241 pieces added to 3.5 miles of Tenmile Creek
Sharing information about watershed processes and function	Improved trust and understanding among partners, and developing common goals

The photos show a road decommissioning project in the Cummins-Tenmile Creek watershed. The access planning team concluded this section of road was no longer needed. Road removal allows the stream full access to the floodplain during winter high flows. With greater access to floodplain habitat and backwaters, the stream channel now retains large wood and other roughness elements important for fish habitat.

Tenmile Creek

HIGHLIGHTED WATERSHED

Results and Change

Oregon Department of Fish and Wildlife, the Waldport District of the Siuslaw National Forest, and private landowners are working together to determine how restoration treatments influence the amount and quality of fish habitat and the total abundance of juvenile salmon, steelhead, and cutthroat trout. The 12-year study began in 1991, examining the number of these fish before and after wood was added to the stream in 1996.

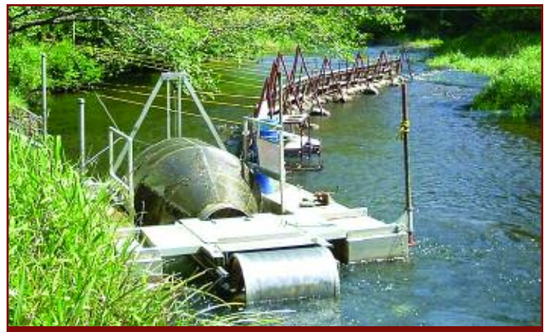
- In Tenmile Creek, a February 1996 flood and October 1996 restoration project combined to improve stream conditions by producing over a five fold increase in pieces of large wood in the stream.
- Fish habitat has increased in complexity—the area of deep pools with wood cover tripled and the surface area of side channel habitat has increased by 50 percent.
- Since large wood was added (through projects and naturally), winter survival of coho and steelhead have significantly increased in Tenmile Creek while the control basin (without any treatment) remained unchanged; steelhead smolt production has doubled; and coho smolt production has not changed (due to low abundance of spawning adults).

Partners

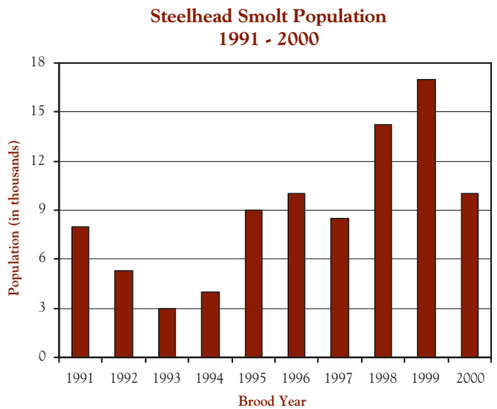
Twenty-three organizations are involved in the Tenmile Creek Watershed restoration project. Participants range from local landowners to conservation groups to private forest management companies.

"I am very impressed with the conservation efforts and long-term commitment from Oregon Department of Fish and Wildlife, the Siuslaw National Forest staff as well as our community members. The Tenmile Creek conservation project is truly a model for restoration and protection of habitats critical to ESA listed species. The monitoring strategy which clearly shows the benefits of our efforts is now being used to help others understand watershed function and productivity."

Paul Engelmeyer
Manager of Audubon's Tenmile Creek Sanctuary



Smolt traps are used to monitor fish population response to restoration treatments.



Steelhead smolt abundance in Tenmile Creek averaged 2.5 times higher after the restoration projects were installed in 1996. Brood years (when fish were spawned) from 1995-2000 were positively influenced by the addition of large wood. Data from S. Johnson et al in the Canadian Journal of Fisheries and Aquatic Sciences.

Contact Information

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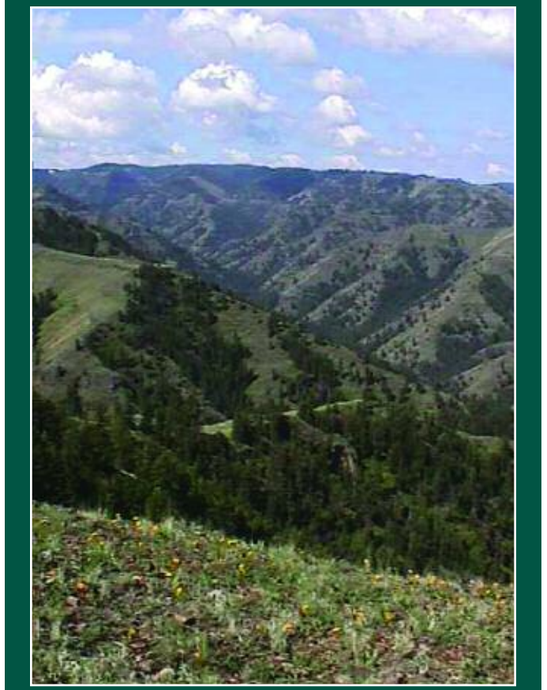
Asotin Creek

HIGHLIGHTED WATERSHED



Asotin Creek Watershed

Umatilla National Forest

Asotin County Conservation District
Washington Dept. of Fish and Wildlife
Nez Perce Tribe
Bonneville Power Administration

History of Asotin Creek

- The name "Asotin" is derived from the Nez Perce word "Heustiin", or "Place of Eels."
- Extensive logging, farming and ranching practices were established over 100 years ago.
- The Model Watershed Program was established in 1995 to improve community-based habitat protection and restoration on a watershed scale.

Asotin Creek Watershed

- Area: 325 square miles (30% managed for crops, 30% range, 40% forest lands)
- More than 60% of the watershed is privately owned
- Habitat: 95 miles of fish bearing streams
- ESA listed species: steelhead, Chinook salmon, and bull trout
- Other fish species: rainbow trout, dace, suckers, lamprey, redside shiner, sculpin
- Watershed analysis completed 1994 and 2001; Watershed restoration plan completed 1995
- Priority restoration completed between 1999 and 2003.

The Need for Restoration

Increased erosion and sedimentation of streams (associated with extensive road system) are major issues addressed by Asotin Creek restoration.

Asotin Creek

HIGHLIGHTED WATERSHED

Restoration Approach

The Asotin Creek Model Watershed Plan was completed in 1995 and served as the guide for ridge-top to ridge-top restoration to benefit riparian and aquatic habitats. It was the first of its kind completed in Washington State. The purpose of the Plan was to better protect aquatic resources in the watershed and restore habitat for salmonids in this Snake River tributary. The Plan identified and prioritized the need for instream, riparian, and upland (including range, crop, and forested lands) treatments.

Restoration Objective	Treatments
Reduce road-related erosion and accelerated sediment delivery to streams	– Road stabilization and decommissioning – Native plantings – Use of best management practices to reduce erosion on crop and range lands
Enhance connectivity of floodplain with the stream channel and stabilize streambanks	– Native riparian plantings – Livestock fencing along streams – Alternative water developments – Protection of prioritized habitat
Enhance in-stream habitat conditions through improved sinuosity, reduced temperatures, and complex habitat structure	– Reconstruct stream meanders – Addition of large wood and boulders to streams – Livestock fencing and alternative water developments

Asotin Creek Conservation District Mission Statement:

"To advocate, educate, and assist people in responsible land management and agricultural practices that conserve and improve air, soil and water quality, fish and wildlife habitat for present and future generations."

Volunteers, students, and Salmon Corps assisted with riparian plantings. Several pieces of innovative machinery were developed to aid in restoration. A small tracked excavator with a "stinger" attachment (shown in photo) was used to "drill" plantings further down into the water table.

Channelized, linear stream segments were "re-meandered", to emulate natural stream patterns, stabilize banks, and improve aquatic habitat. A variety of native trees and shrubs were planted: four varieties of willow, cottonwood, red osier dogwood, blue elderberry, ponderosa pine, Douglas fir and quaking aspen.

Asotin Creek

HIGHLIGHTED WATERSHED

Restoration Accomplishments

Restoration projects in the Asotin Creek Watershed, conducted between 1999 and 2003, emphasized improvement of riparian/floodplain vegetation conditions and the recovery of stream channel stability. In addition, there were a number of projects on private land, addressing the agricultural and livestock uses in the watershed, including the development of alternative watering sites and planting of pastureland.

Restoration Treatment	Accomplishments
Road stabilization	72.5 miles of road decommissioned and recontoured
Riparian planting and protection	85,191 trees planted in riparian areas 15,100 linear feet of livestock fencing installed 15 troughs and off-water sites created for livestock 8.3 miles (151 acres) of stream buffer protected and enhanced through CREP program
Wood and boulder additions to stream channels	122 pools were constructed adding to stream habitat complexity
Stream meander reconstruction	1,330 feet of stream channel reconstructed with meanders
Sediment basins	14 ponds completed
Grass/pasture plantings	4,000 acres planted

The Koch Project "re-meandered" an important section of Asotin Creek. The project increased the length of stream channel by more than 40% and the amount of pool habitat by more than 33%.

Asotin Creek

HIGHLIGHTED WATERSHED

Results and Change

Monitoring of in-channel stream conditions, fish populations, and riparian vegetation is a cooperative effort between the Forest Service, the State, and Asotin County Conservation District.

- Restored stream sections showed better resiliency when hit by the 1996 and 1997 floods.
- Instream projects have increased the number and quality of pools while reducing the width of the stream channel. Surveys show that the number of pools has increased by more than 1/3 since treatment.
- Summer stream temperature monitoring shows temperatures have been reduced sufficiently to increase habitat for ESA listed trout and salmon by approximately 5 miles.
- Monitoring indicates a substantial reduction of sediment in the stream bed, enhancing water quality and fish habitat.
- 72.5 miles of roads have been decommissioned and re-contoured since 2000.

Partners

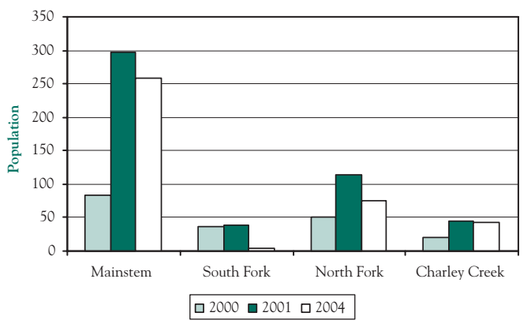
"What happens on private, Federal, and State ground in one of these watersheds all works together . . . We all have a great stake to be involved, it's our future."

Jay Holzmiller
Asotin County, landowner and rancher

The Asotin Creek Watershed Plan resulted from collaboration between a local Landowner Steering Committee and an Agency Technical Advisory Group, both formed in 1993. There are 40 partners involved in habitat restoration and protection projects in the Asotin watershed, including federal, state, and county agencies, tribal members, conservation groups, and local landowners.

Monitoring has included measuring stream width, pool frequency and depth, and average stream depth.

Steelhead Redd Counts in Asotin Creek 2000 - 2004



The number of steelhead redds (nests), are an indicator of stream health and adult fish populations. Note: Water levels were too high during spawning season in 2002/03 to complete surveys in those years.

Contact Information

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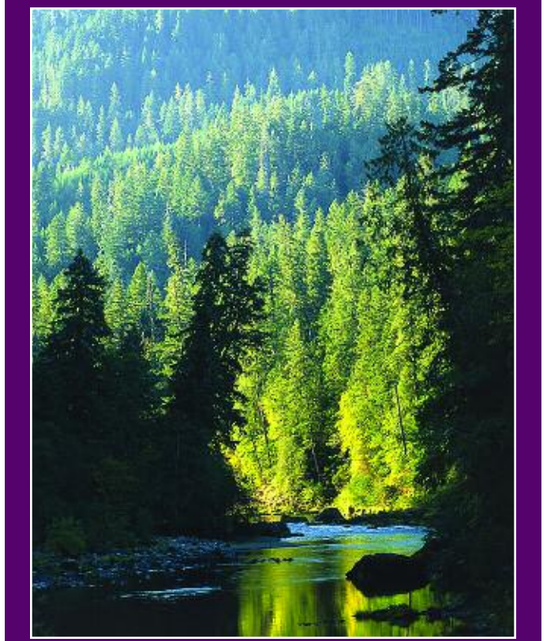
Little Rock Creek

HIGHLIGHTED WATERSHED



Little Rock Creek is in the North Umpqua River system. Photo by Earth Justice. All other Little Rock photos by USFS.

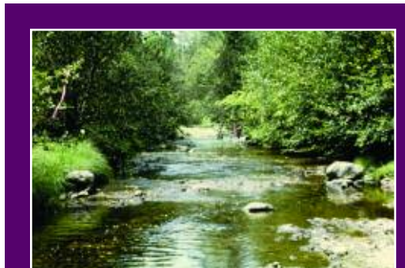
Umpqua National Forest

History of Little Rock Creek

- Little Rock Creek was managed with a timber emphasis until the 1990's.
- Increased levels of downed wood and other fuels in riparian and upslope areas, tied to fire suppression, were an increasing risk to the integrity of the watershed.
- Limited road maintenance, tied to reduced funding, was causing high levels of sediment to be deposited in streams.

Little Rock Creek Watershed

- Area: 15 square miles
- Habitat and fish species: Seven miles of steelhead habitat and 16 miles of Umpqua cutthroat trout habitat
- The entire watershed is National Forest System land
- Tier 1 Key Watershed and part of a 300,000 acre late-successional reserve
- Water quality is impaired: high summer stream temperatures, sediment, and habitat simplification
- 80% of road-related landslides in Little Rock Creek due to road-building in high geologically-hazardous terrain
- Watershed analysis completed 1997
- Priority watershed restoration treatments completed between 2000 and 2004.



The Need for Restoration

Prior to restoration, the streambed of Little Rock Creek was dominated by bedrock which provided poor spawning and rearing habitat for fish (left). Roads in the watershed impinged on the floodplain, contributing to sediment and erosion (right).

Little Rock Creek

HIGHLIGHTED WATERSHED

The Restoration Approach

The goal is to restore refuge habitat for steelhead and Umpqua cutthroat trout in a high priority, geologically unstable watershed. Restoration of the Little Rock Creek watershed focused on restoration of natural processes. Stabilizing hillslopes, impacted by road building and water routing problems, was a priority.

Restoration Objective	Treatments
Reduce debris flows triggered by roads	– Road stabilization and decommissioning – Restoration of stream crossings
Accelerate development of late successional conditions	– Thinning – Control of competing vegetation – Riparian planting – Removal of roads next to streams
Increase salmonid freshwater survival rates and restore channel complexity	– Addition of wood to streams – Removal of roads next to streams

A large, heavy-lift helicopter was used to bring 550 logs into eight miles of Little Rock Creek and three of its tributaries. This was done to restore the large wood habitat that was lost as a result of the 1964 floods and subsequent stream cleanout in the 1960s and 1970s. The logs, all downed by storms in 1996, were gathered from nearby roads. Large wood is important to stream health and fish habitat development, providing hiding cover, physical structure to form pools and trap spawning gravels/ sediment, and a steady source of nutrients.

Many road-stream crossings in this watershed altered sediment and debris movement in stream channels and blocked fish passage (left). Restoration projects have returned channels to a natural grade and condition. In many instances, road decommissioning removed a stream crossing completely (right).

Little Rock Creek

HIGHLIGHTED WATERSHED

Restoration Accomplishments

Restoration activities were completed between 2000 and 2004. Projects focused on removal of high priority, high impact roads located on the mid-slope and valley bottoms. Eight miles of important steelhead stream habitat were also treated.

Restoration Treatment	Accomplishments
Road stabilization and decommissioning	All mid-slope and valley bottom roads were treated: – 42% (24 of the basin's 56.5 miles) of roads decommissioned – 14 miles of ridge top road were reconstructed
Riparian thinning and replanting	60 acres of pre-commercial thinning adjacent to streams 35 acres of commercial thinning adjacent to streams Planting diverse species such as western redcedar and big leaf maple
Wood additions to stream channels	550 pieces added to 8 miles of Little Rock Creek

This sequence of photographs shows the progression of a representative stream channel restoration site in the Little Rock Creek Watershed. Large wood was introduced in 2000 to enhance fish habitat. Two years after project implementation, surveyors found numerous juvenile steelhead utilizing pools and backwater habitat created by the large wood jam.

Little Rock Creek

HIGHLIGHTED WATERSHED

Results and Change

Monitoring of restoration projects in the Little Rock Creek watershed includes surveys of macroinvertebrates, stream temperature, pebble counts, channel cross-sections, amphibians, and fish spawning.

- The primary monitoring emphasis to-date has been project photo points, which clearly show accumulation of gravels (critical for fish spawning) since project implementation.
- 70% of roads in the watershed were removed, restoring stream habitat and drainage connections.
- Fish habitat was improved: large wood increased from an average of 20 pieces/mile to about 69 pieces/mile.
- More than 200 cross-sections have been established; monitoring is planned to further track accumulated gravel and pool creation. This has not yet been implemented due to lack of large channel-affecting flow events and reduced funding.

Partners

A wide range of partners are involved in the Little Rock Creek Watershed restoration project. They range from local watershed councils to conservation groups to state agencies. Partners contribute toward project design, monitoring, funding, and administration.

"The Forest Service has really built goodwill among conservation groups with their holistic approach to watershed restoration. This isn't just the streams, they've looked at all the ecosystem processes in the watershed and are systematically handling all the problems."

Robin Hartmann
Executive Director of
The North Umpqua Foundation

Contact Information

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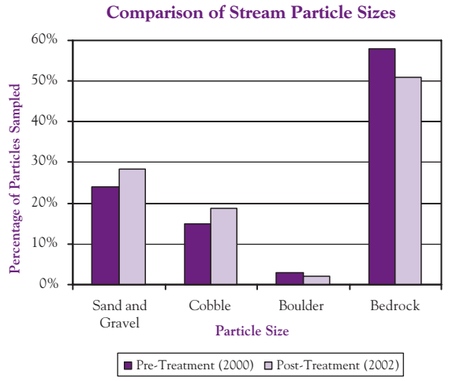
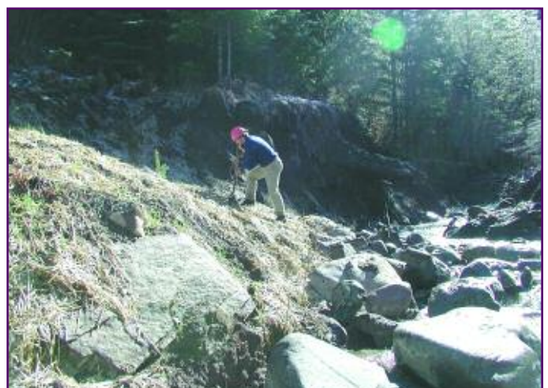
Barbara Fontaine, Umpqua National Forest 541.957.3422



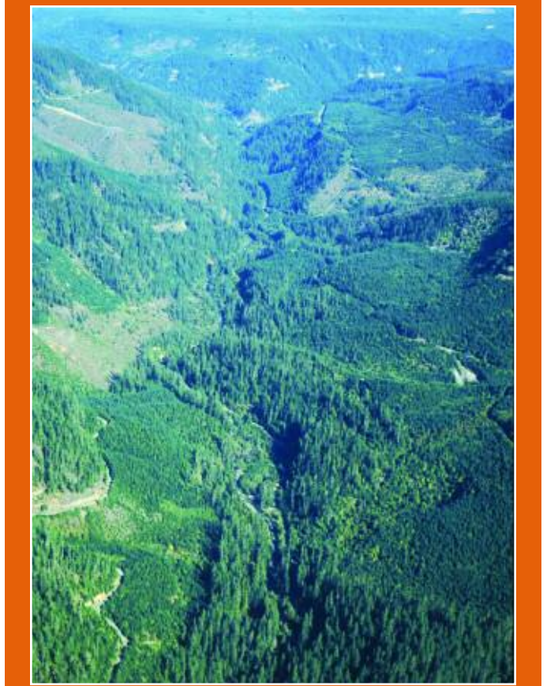
Gravel substrate is required for successful steelhead spawning, and cobbles provide important winter habitat. Two winters following placement of large wood, the percent of the reach containing gravel and finer material increased from 15% to 25% Over time, finer particles are expected to accumulate as winter storms recruit and sort sediment around the instream wood.



Volunteers worked with Forest Service employees to plant willow, Western red cedar, and Douglas-fir trees along riparian areas where roads were decommissioned and stream crossings were removed.

Fish Creek

HIGHLIGHTED WATERSHED



Fish Creek Watershed.

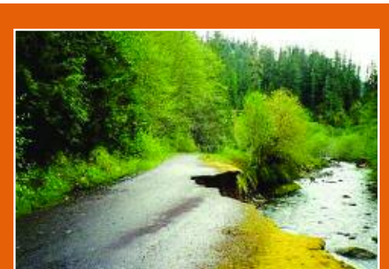
Mt. Hood National Forest

History of Fish Creek

- Extensive logging and road building began in the 1950's.
- Major floods struck the watershed in the mid 90's. Seventy-three percent of the road system was damaged.

Fish Creek Watershed

- Area: 47 square miles
- Habitat: 42.5 fish-bearing miles
- The entire watershed is National Forest System land
- Most geologically unstable watershed on the Mt. Hood National Forest
- Tier 1 Key Watershed
- Water quality is impaired: high summer temperatures and habitat simplification
- ESA listed species: steelhead, Chinook and coho salmon
- Other fish species: whitefish, rainbow and cutthroat trout
- Long term monitoring partnership with the Pacific Northwest Research Station
- Watershed Analysis, 1994; Watershed Restoration Plan, 2000; Watershed Monitoring Plan, 2001
- Priority restoration treatments completed between 1998 and 2002.



The Need for Restoration

Before restoration wood added to streams by landslides was often trapped behind culverts— causing major debris jams and forcing the stream to create new channels (left). Floods and landslides triggered road washouts and damage along Fish Creek and its tributaries (right). All Fish Creek photos by USFS.

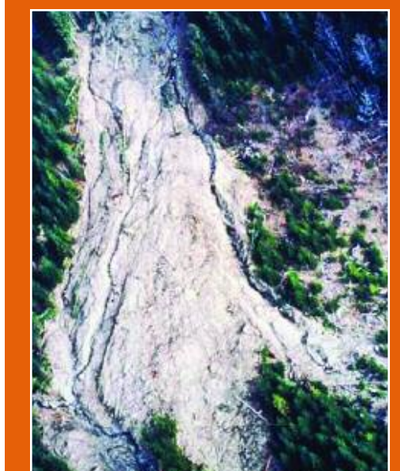
Fish Creek

HIGHLIGHTED WATERSHED

Restoration Approach

Restoration in Fish Creek watershed focused on restoring natural patterns of habitat-forming processes (ie, stream transport of logs and sediment, historic rates of landslides, etc), plus reducing the impact of past management activities and improving habitat for important aquatic species.

Restoration Objective	Treatments
Reduce management-related landslides and allow natural disturbances (landslides, floods, windstorms, etc.) to contribute to stream structure and function	– Road stabilization and decommissioning – Restoration of "natural" road-stream crossings – Thin young plantations and accelerate tree growth
Accelerate development of late successional conditions in riparian reserves	– Thinning – Control of competing vegetation – Riparian planting – Removal of roads next to streams
Increase salmonid freshwater survival rates and restore channel and aquatic habitat complexity	– Addition of wood to streams – Removal of roads next to streams – Allow natural disturbances to add roughness elements



Tree plantations (harvested areas less than 20 years old) had ten times the landslide rate than that of old growth stands. Many landslides were replanted, and adjacent plantations were thinned to accelerate tree growth.

An estimated one million pounds of culverts were removed from Fish Creek watershed.

A key step in the restoration of the Fish Creek watershed was road decommissioning. By removing culverts and restoring the natural flow of water and stream habitat components, such as large wood, streams are healthier and provide better habitat for fish.

Fish Creek

HIGHLIGHTED WATERSHED

Restoration Accomplishments

Most of the priority restoration was completed 1998-2002. Road decommissioning (especially on unstable slopes and floodplains) and stream crossing restoration were emphasized to reduce risk and chronic impacts associated with the extensive road system. Thinning projects on hill-slopes and in riparian areas helped accelerate production of large trees, promoting slope stability and reducing landslide rates. Large wood placement at key sites in fish-bearing reaches initiated rebuilding of habitat-forming logjams lost during floods and debris torrents.

Restoration Treatment	Accomplishments
Road stabilization	107 miles of roads decommissioned 36 miles of roads reconstructed and stormproofed 1,169 culverts removed and natural stream crossings restored 549 acres of erosion control (seed, fertilize, and mulch) placed at sensitive areas
Hillslope treatments	1,431 acres of thinning 50 acres planted in landslide areas
Riparian planting and understory release	2,056 acres of Douglas fir plantations thinned 3 acres planted with diverse species such as western red cedar
Wood additions to stream channels	Built 7 log jams in lower 3 miles of stream Restored 1 mile of side channel

The two photos above (before and after) show typical results of Fish Creek road-stream crossing restoration. The road crossing on Third Creek was obliterated, the culverts were removed, and the stream bank was returned to its natural grade. Large wood deposited in the 1996 flood was moved back into the stream channel to enhance fish habitat. Following reconstruction of the stream channel, erosion control materials were applied. Shrubs and trees, such as the alder, sprouted naturally.

Fish Creek

HIGHLIGHTED WATERSHED

Results and Change

Many aspects of Fish Creek restoration are monitored to track project results. These include hill-slope stability (number of landslides in restored areas compared to natural areas), riparian area conditions (levels of shading and nutrients), and instream conditions (fish habitat and fish populations.) Much of the benefit from restoration work will take years to become evident, following large-scale disturbance such as floods and windstorms.

Fish populations are monitored through a partnership with the Pacific Northwest Research Station in Corvallis, Oregon. The graph at right shows response of fish populations from 1995-2003.

Partners

The Federal Highway Administration provided critical assistance in project design and contract administration.

Contact Information

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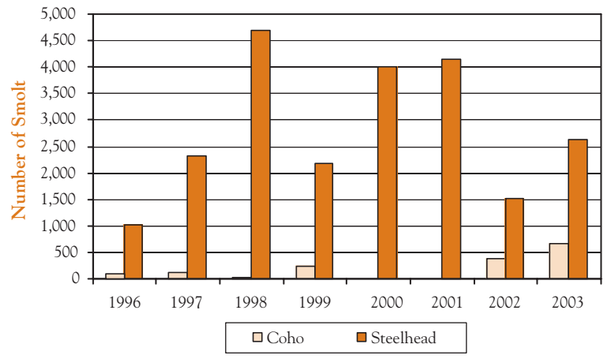
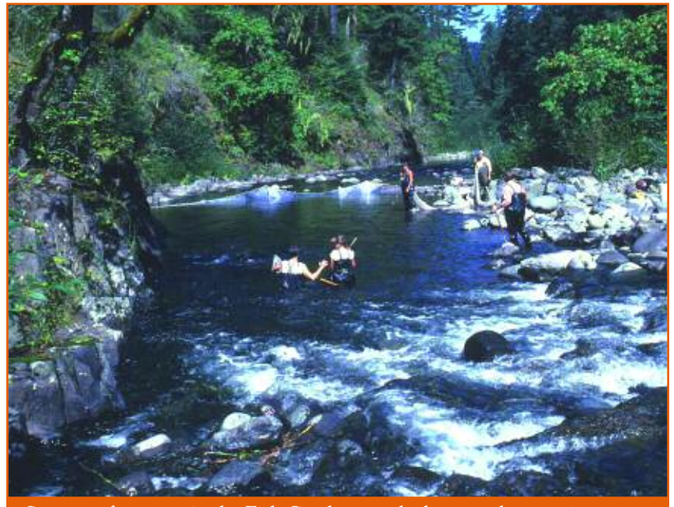
Smolt Production Estimates in Fish Creek Watershed
1995 - 2003



The complicated, ocean-going life cycle of Pacific salmon makes it difficult to explain change in populations. The graph shows the impact of the 1996 flood and the subsequent rebuilding of the populations.



Surveys of streams in the Fish Creek watershed are used to monitor long-term effects of restoration.

Prescribed Fire

HIGHLIGHTED RESTORATION TECHNIQUES

Meadow Creek Watershed
Wallowa-Whitman National Forest

Many ecosystems are fire-adapted, but humans have suppressed fire for more than a century. This has led to increased fuel loading and altered vegetation communities. Prescribed fire is a tool that can be used to improve the resiliency and complexity of riparian vegetation.

More than 100 years of sheep and cattle grazing, fire suppression, clearcut timber harvests and extensive road building altered the character and health of the Meadow Creek Watershed. This watershed was faced with an accumulation of fuels, overstocked tree plantations with low structural diversity, unstable streambanks, compacted soil, and invasive plant species.

Fire is a natural part of the ecosystem's disturbance regime in the Meadow Creek watershed. Reintroducing fire through prescribed burns on 1200 acres helped to remove overly dense shrubs and other understory vegetation—reducing the risk of a catastrophic wildfire, removing noxious weeds, restoring native plants, and allowing trees to grow larger more quickly. This can provide benefits to the aquatic system through contributions of large wood into the stream systems and greater shading of streams which enhances fish habitat.

Prescribed burns were important in reducing invasive, non-native plant species and the build up of fuels. The result is an ecosystem with more native species and a reduced risk of catastrophe from wildfire.

Fire is a restoration tool that can be used in conjunction with other treatments. The Meadow Creek ecosystem also benefited from thinning, noxious weed treatment, reestablishment of native grasses, fencing of riparian areas, culvert replacements and road decommissioning.

Fuels were reduced in the Meadow Creek watershed using a combination of thinning and prescribed fires.These photos show an area before and after treatment.

Stream Channel Reconstruction

HIGHLIGHTED RESTORATION TECHNIQUES

Bailey Creek
Siuslaw National Forest

Many streams were channelized and straightened when valleys were settled and cleared. Stream channel reconstruction restores stream channel form and habitat complexity that provides important fish habitat.

Channel reconstruction on Bailey Creek "re-meandered" more than one mile of straightened stream, resulting in significantly improved fish habitat, reduced sedimentation, and reestablished connection with the floodplain. Previously, as an agricultural pasture, the stream had been straightened and channelized which led to channel incision and erosion of the banks, increased water velocity, and degraded water quality and fish habitat.

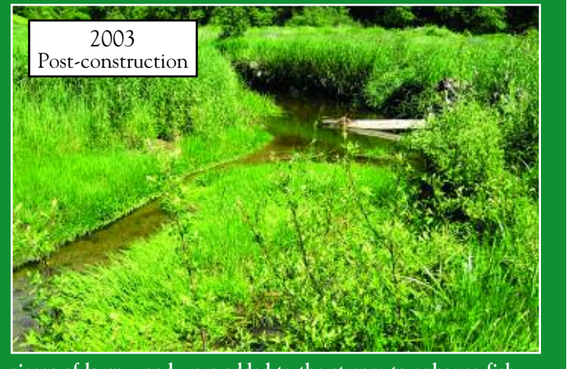
This project focused on restoring wetland, stream, and floodplain functions to an area that historically provided high quality habitat for coho salmon, an ESA threatened species. As a result, monitoring has documented a ten-fold increase in the number of juvenile coho in the project area.

Major steps involved in this technique include:

1. Gathering information on existing conditions and on a non-channelized reference stream.

The Bailey Creek Project restored natural conditions by increasing channel length by 1/3 and doubling the volume of stream pools.

2. Determining desired plan-view channel characteristics and fitting these into an appropriate channel design/map.
3. Design of pool-riffle shaping for stream bottom.
4. Excavation of new channel.
5. Addition of wood to channel and planting of the riparian zone.



After the new meandering channel was constructed in 1999 (left), pieces of large wood were added to the stream to enhance fish habitat. As the riparian vegetation matures, it will cool the stream by providing shade.

Wetland Restoration

HIGHLIGHTED RESTORATION TECHNIQUES

Big Marsh Creek Watershed
Deschutes National Forest

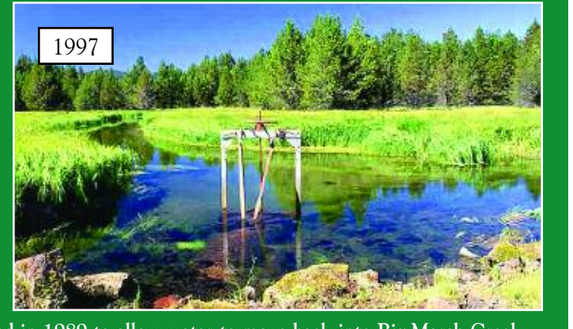
Draining and clearing of land for pastures and crops has severely altered many natural wetlands and the important fish and wildlife habitat they provide. Wetland restoration uses a variety of tools to return water to these landscapes.

Wetland restoration of Big Marsh Creek (a Wild and Scenic River) enhanced stream conditions, fish habitat, and native plants in this high-elevation marsh complex. Historically, a series of beaver dams created a water depth of 12 to 20 inches in the 2,250 acre marsh. In 1946, ditches were constructed draining the marsh for cattle grazing.

Natural movement of water through the marsh was restored by diverting water from the existing ditches back into Big Marsh Creek and its wetlands. A series of small "check dams" were constructed in the existing ditches to decrease water flow, allowing sediment to settle and water to infiltrate back into the marsh. This recaptured 3 miles of stream and returned 90% of the water to its historic channel.

Fire, a natural part of this ecosystem, was reintroduced into this marsh to accelerate the establishment of native plants. In addition to burning 150 acres, 65 acres of encroaching lodgepole pine were removed. Grazing was phased out in 1988, further promoting recovery of the native plant community.

Excavators were used in restoring the hydrology of the Big Marsh Creek ecosystem. Removal of human-built ditches and returning the stream to its natural channel enhances habitat for many species including redband trout, Oregon spotted frogs, Sandhill cranes, and yellow rails.



A "head gate", controlling the rate of water flow, was constructed in 1989 to allow water to move back into Big Marsh Creek (left). It was removed in 1997, and historic stream channels that had filled in were also excavated (right).

Looking Forward

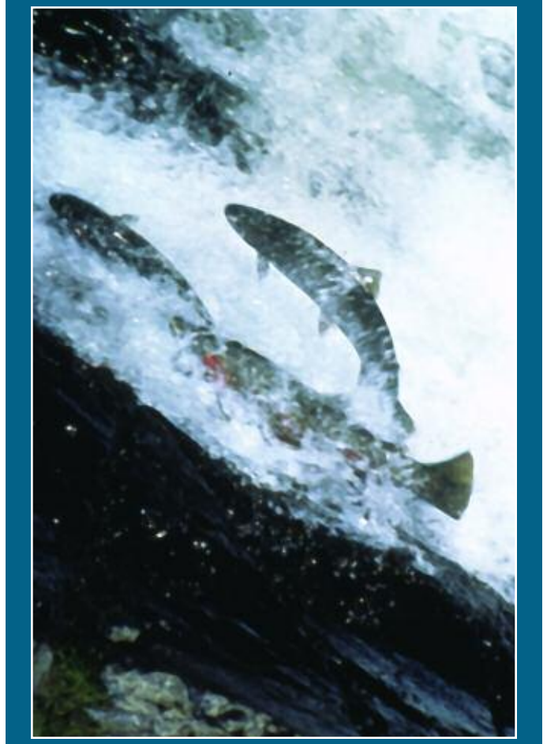
WHOLE WATERSHED RESTORATION

Restoration is both a science and an art form. It is the work of dedicated people working together to make a change on the land. Over the last ten years, much has been learned about the analysis and restoration of whole watersheds and there have been some important accomplishments. Fish habitat is showing significant improvement in many areas and natural processes are re-establishing themselves. Monitoring in many watersheds has shown increases in juvenile fish and in the production of young salmon that migrate to the sea to mature. A talented cadre of interdisciplinary skills has been developed. Working in a team setting, they assess whole watershed conditions and trends and design integrated treatments needed to speed the process of restoration. There has also been exciting participation and engagement with local communities, land owners and a variety of interest groups to work in partnership to address conditions across all ownerships. All of this has provided valuable learning and experience for the future. Many lessons will be drawn upon in the future to provide a more effective and efficient restoration program.

A new Regional Aquatic Restoration Strategy is now underway. It provides improved focus and organization for restoration at the Regional scale. The Strategy seeks to:

- Provide a more consistent process for prioritizing and focusing work;
- Increase the rate for completion of high priority restoration in important watersheds by at least 25%,
- Expand partnerships and increase the leveraging of funds as well as improve integration of restoration with local, State and Federal programs for salmon, listed fish species and water quality recovery.

There will be many new challenges. They will be met by a team whose mutual interest is the health of watersheds, aquatic habitat and communities. The role of partnerships will continue to grow and provide strength to the program. We believe that the future is bright and the opportunities for continuing success are good. We appreciate your interest in the program and look forward to your continued future participation and support.



Healthy watersheds and fish populations are a strong indicator of ecosystem health and contribute to community well-being.

For questions or additional information, please contact:

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